

What is claimed is:

- 5 1. A cardiac assist system, comprising:
a primary device housing;
said primary device housing having a control circuit therein;
a shielding formed around said primary device housing to shield said
primary device housing and any circuits therein from electromagnetic
10 interference; and
a biocompatible material formed around said shielding.
- 15 2. The cardiac assist system as claimed in claim 1, wherein said
shielding is a metallic sheath to shield said primary device housing and any
circuits therein from electromagnetic interference.
- 20 3. The cardiac assist system as claimed in claim 1, wherein said
shielding is a carbon composite sheath to shield said primary device housing
and any circuits therein from electromagnetic interference.
- 25 4. The cardiac assist system as claimed in claim 1, wherein said
shielding is a polymer composite sheath to shield said primary device
housing and any circuits therein from electromagnetic interference.
5. The cardiac assist system as claimed in claim 1, wherein said
biocompatible material is a non-permeable diffusion resistant biocompatible
material.

6. A tissue invasive device, comprising:

a primary device housing;

said primary device housing having a control circuit therein;

5 a shielding formed around said primary device housing to shield said primary device housing and any circuits therein from electromagnetic interference; and

a biocompatible material formed around said shielding.

10 7. The tissue invasive device as claimed in claim 6, wherein said shielding is a metallic sheath to shield said primary device housing and any circuits therein from electromagnetic interference.

15 8. The tissue invasive device as claimed in claim 6, wherein said shielding is a carbon composite sheath to shield said primary device housing and any circuits therein from electromagnetic interference.

20 9. The tissue invasive device as claimed in claim 6, wherein said shielding is a polymer composite sheath to shield said primary device housing and any circuits therein from electromagnetic interference.

25 10. The tissue invasive device as claimed in claim 6, wherein said biocompatible material is a non-permeable diffusion resistant biocompatible material.

11. A cardiac assist system, comprising:

a primary device housing;
said primary device housing having a control circuit therein;
a shielding formed around said primary device housing to shield said
primary device housing and any circuits therein from electromagnetic
interference;
a biocompatible material formed around said shielding; and
a detection circuit, located in said primary device housing, to detect an
electromagnetic interference insult upon the cardiac assist system;
said control circuit placing the cardiac assist system in an
asynchronous mode upon detection of the electromagnetic interference insult
by said detection system.

12. The cardiac assist system as claimed in claim 11, wherein said
shielding is a metallic sheath to shield said primary device housing and any
circuits therein from electromagnetic interference.

13. The cardiac assist system as claimed in claim 11, wherein said
shielding is a carbon composite sheath to shield said primary device housing
and any circuits therein from electromagnetic interference.

14. The cardiac assist system as claimed in claim 11, wherein said
shielding is a polymer composite sheath to shield said primary device
housing and any circuits therein from electromagnetic interference.

15. The cardiac assist system as claimed in claim 11, wherein said biocompatible material is a non-permeable diffusion resistant biocompatible material.

5 16. A tissue invasive device, comprising:
a primary device housing;
said primary device housing having a control circuit therein operating in a first mode;

10 a shielding formed around said primary device housing to shield said primary device housing and any circuits therein from electromagnetic interference;

 a biocompatible material formed around said shielding; and
 a detection circuit, located in said primary device housing, to detect an electromagnetic interference insult upon the tissue invasive device;

15 said control circuit placing the tissue invasive device in a second mode upon detection of the electromagnetic interference insult by said detection system.

20 17. The tissue invasive device as claimed in claim 16, wherein said shielding is a metallic sheath to shield said primary device housing and any circuits therein from electromagnetic interference.

25 18. The tissue invasive device as claimed in claim 16, wherein said shielding is a carbon composite sheath to shield said primary device housing and any circuits therein from electromagnetic interference.

19. The tissue invasive device as claimed in claim 16, wherein said shielding is a polymer composite sheath to shield said primary device housing and any circuits therein from electromagnetic interference.

5 20. The tissue invasive device as claimed in claim 16, wherein said biocompatible material is a non-permeable diffusion resistant biocompatible material.

10 21. A cardiac assist system, comprising:
a primary device housing having a first control circuit, therein, to perform synchronous cardiac assist operations;
a first shielding formed around said primary device housing to shield said primary device housing and any circuits therein from electromagnetic
15 interference;
a first biocompatible material formed around said first shielding;
a secondary device housing having a second control circuit, therein, to perform asynchronous cardiac assist operations;
a second shielding formed around said secondary device housing to
20 shield said secondary device housing and any circuits therein from electromagnetic interference;
a second biocompatible material formed around said second shielding;
and
a detection circuit, communicatively coupled to said first and second
25 control circuits, to detect an electromagnetic interference insult upon the cardiac assist system;

said first control circuit terminating synchronous cardiac assist operations and said second control circuit initiating asynchronous cardiac assist operations upon detection of the electromagnetic interference insult by said detection system.

22. The cardiac assist system as claimed in claim 21, wherein said first and second shielding are metallic sheaths to shield said primary and secondary device housings and any circuits therein from electromagnetic interference.

23. The cardiac assist system as claimed in claim 21, wherein said first and second shielding are carbon composite sheaths to shield said primary and secondary device housings and any circuits therein from electromagnetic interference.

24. The cardiac assist system as claimed in claim 21, wherein said first and second shielding are polymer composite sheaths to shield said primary and secondary device housings and any circuits therein from electromagnetic interference.

25. The cardiac assist system as claimed in claim 21, wherein said first and second biocompatible materials are non-permeable diffusion resistant biocompatible materials.

26. A cardiac assist system for implanting in a body of a patient, the cardiac assist system comprising:

a main module;

a first shielding formed around said main module to shield said main module and any circuits therein from magnetic-resonance imaging interference;

5 a first biocompatible material formed around said first shielding;

a magnetic-resonance imaging-immune auxiliary module;

a second shielding formed around said magnetic-resonance imaging-immune auxiliary module to shield said magnetic-resonance imaging-immune auxiliary module and any circuits therein from magnetic-resonance
10 imaging interference;

a second biocompatible material formed around said second shielding;

a communication channel between said main module and said magnetic-resonance imaging-immune auxiliary module for said magnetic-resonance imaging-immune auxiliary module to detect failure of said main
15 module; and

a controller for activating said magnetic-resonance imaging-immune auxiliary module upon detection of failure of said main module.

20 27. The cardiac assist system as claimed in claim 26, wherein said first and second shieldings are metallic sheaths to shield said main and magnetic-resonance imaging-immune auxiliary modules and any circuits therein from magnetic-resonance imaging interference.

25 28. The cardiac assist system as claimed in claim 26, wherein said first and second shieldings are carbon composite sheaths to shield said main

and magnetic-resonance imaging-immune auxiliary modules and any circuits therein from magnetic-resonance imaging interference.

29. The cardiac assist system as claimed in claim 26, wherein said first and second shieldings are polymer composite sheaths to shield said main and magnetic-resonance imaging-immune auxiliary modules and any circuits therein from magnetic-resonance imaging interference.

30. The cardiac assist system as claimed in claim 26, wherein said first and second biocompatible materials are non-permeable diffusion resistant biocompatible materials.

31. A cardiac assist system for implanting in the body of a patient, the cardiac assist system comprising:

- a main module;
- a first biocompatible material formed around said main module;
- an magnetic-resonance imaging-hardened auxiliary module;
- a shielding formed around said magnetic-resonance imaging-hardened auxiliary module to shield said magnetic-resonance imaging-hardened auxiliary module and any circuits therein from magnetic-resonance imaging interference;
- a second biocompatible material formed around said second shielding;
- and
- a communication channel between said main module and said magnetic-resonance imaging-hardened auxiliary module;

said magnetic-resonance imaging-hardened auxiliary module
detecting, through said communication channel, failure of said main module;

said magnetic-resonance imaging-hardened auxiliary module
including a controller for activating said magnetic-resonance imaging-
hardened auxiliary module upon detection of failure of said main module.

32. The cardiac assist system as claimed in claim 31, wherein said
shielding is a metallic sheath to shield said magnetic-resonance imaging-
hardened auxiliary module and any circuits therein from magnetic-resonance
imaging interference.

33. The cardiac assist system as claimed in claim 31, wherein said
shielding is a carbon composite sheath to shield said magnetic-resonance
imaging-hardened auxiliary module and any circuits therein from magnetic-
resonance imaging interference.

34. The cardiac assist system as claimed in claim 31, wherein said
shielding is a polymer composite sheath to shield said magnetic-resonance
imaging-hardened auxiliary module and any circuits therein from magnetic-
resonance imaging interference.

35. The cardiac assist system as claimed in claim 31, wherein said
first and second biocompatible materials are non-permeable diffusion
resistant biocompatible materials.

36. The cardiac assist system as claimed in claim 21, wherein said first shielding is metallic sheaths to shield said primary and secondary device housings and any circuits therein from electromagnetic interference.

5 37. The cardiac assist system as claimed in claim 21, wherein said first shielding is carbon composite sheaths to shield said primary and secondary device housings and any circuits therein from electromagnetic interference.

10 38. The cardiac assist system as claimed in claim 21, wherein said first shielding is polymer composite sheaths to shield said primary and secondary device housings and any circuits therein from electromagnetic interference.

15 39. The cardiac assist system as claimed in claim 26, wherein said first shielding is metallic sheaths to shield said main and magnetic-resonance imaging-immune auxiliary modules and any circuits therein from magnetic-resonance imaging interference.

20 40. The cardiac assist system as claimed in claim 26, wherein said first shielding is carbon composite sheaths to shield said main and magnetic-resonance imaging-immune auxiliary modules and any circuits therein from magnetic-resonance imaging interference.

25 41. The cardiac assist system as claimed in claim 26, wherein said first and second shielding is polymer composite sheaths to shield said main

and magnetic-resonance imaging-immune auxiliary modules and any circuits therein from magnetic-resonance imaging interference.